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**DEVICE AND METHOD FOR CONTROLLING THE CONDENSATE AND/OR  
FROST FORMATION IN CHOCOLATE SHELL PRODUCTION****TECHNICAL FIELD**

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The present invention relates to the technical field regarding the production of chocolate food products and it refers to a device and to a method for controlling the condensate or frost formation in chocolate shell production, particularly by means of a mould provided with a plurality of recesses for liquefied and/or softened chocolate and with a cooled die including a plurality of protrusions each fit to be inserted in a respective recess in order to form, in cooperation with the latter, a chocolate shell.

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**BACKGROUND ART**

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There are known devices, fit to prevent the noxious formation of water condensate or frost on the protrusions, said devices being provided with a room delimited by side walls, by mould and die and kept in overpressure by air feed means to control the temperature of said air at values lower than the condensation values.

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There are also known devices in which the mould and the die for chocolate shells are housed in a closed container, in which the temperature is maintained substantially below the temperature of the countermould by control means of air temperature.

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The main drawbacks of said known devices and methods consist in that said rooms and containers are difficult to be made, are expensive and cannot be assembled in non pre-arranged machines; furthermore in order to keep controlled the air temperature in such rooms and containers, it is necessary to limit the range of the protrusion temperature and generally the operation modes of the machine.

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**DISCLOSURE OF THE INVENTION**

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An object of the present invention is to propose a device for controlling the condensate or frost formation in chocolate shell-production, whose portion which is associated to die and mould has small dimensions, flows directly in the environment and that, therefore, it does not require rooms or containers.

Other object of the present invention is to propose a method for avoiding the humidity condensation on the die by blowing dehumidified air at the surface thereof with adjustable temperatures in a wide range of values also higher than the temperature values of die protrusion.

## 5 BRIEF DESCRIPTION OF THE DRAWINGS

The characteristics of the present invention are underlined in the following with particular reference to the attached drawings, in which:

- 10 - figure 1 shows a schematic view of the device of the present invention;
- figure 2 shows a schematic and partial view of a portion of figure 1 device including a mould and a die in a condition of mutual detachment thereof;
- figure 3 shows a view of the portion of figure 2 device in a condition of mutual approach of mould and die;
- 15 - figure 4 shows a schematic view of a variant of figure 1 device.

## BEST MODE OF CARRYING OUT THE INVENTION

20 With reference to figures 1 to 3, numeral 1 indicates the device for controlling the condensate or frost formation in the chocolate shell production including a mould 2 provide with a plurality of recess 3 for liquefied or softened chocolate 4 and a die 5 including a plurality of protrusions 6 cooled by cooling means 7.

25 The mould 2 is horizontally positioned below the die 5 and it is vertically driven by a respective lifting means, including electric, pneumatic or hydraulic actuators, of known type and not shown, between a condition of maximum approach A, in which each protrusion 6 is inserted in a respective underlying recess 3 to form a chocolate shell and a condition of mutual detachment D, in which the mould 2 which has moulded shells is removed in order to be replaced by another mould 2 whose recesses 3 bear the chocolate to be moulded.

30 The cooling means 7 include a plurality of ducts extending in the protrusions 6 of die 5 and which are flown by a cooling means, consisting of a glycol solution, an antifreeze fluid or a refrigerant fluid, cooled by refrigerating machine 13 including an expansion refrigerator 19.

35 The refrigerating machine 13 includes dehumidification means 10 provided with a radiator

exchanger 14 and with blowing means 15 for feeding with dehumidified air 50 a whole of supply means 8, fixed to die 5.

5 The radiator exchanger 14 is internally crossed and cooled by the cooling fluid of cooling means 7 or by another fluid refrigerated by the refrigerating machine 13 and it is crossed by an air flow produced by the blowing means 15 of fan type.

The humidity of the ambient air is condensed on the external surface of radiator exchanger, which thus produces the dehumidified air 50 by condensation.

10 The air coming out from the dehumidification means 10 is directed by a duct 12, including filter means 17 for instance with activated carbon, up to connections 11 of supply means 8.

15 Each supply means 8 has an approximately bent delta shape with a side having an outlet 9 for the dehumidified air 50 and the opposed vertex having the connection 11.

20 The outlet 9 of each supply means 8 flows directly in the environment, it is oriented in direction of protrusions 6 and it is fit to blow the dehumidified air 50, in the mutual detachment condition D of mould 2 from die 5, at nearly ambient pressure, in order to avoid condensate or frost formation on the protrusions 6.

25 The outlet 9 of each supply means 8 is aligned with or below the lower face of die 5, having the protrusions 6, and it is inclined toward said face; besides the outlet has an extended shape and it is approximately parallel to a respective side of the die 5.

Each outlet 9 has a length approximately equal to the length of the corresponding side of die 5.

30 In the shown embodiment, the device 1 include a supply means 8 for each side of die 5, but the invention also provides that only one, two or three sides of the rectangular die 5 have a respective supply means 8.

The invention further provides that the device has only one supply means 8 provided with outlets 9 corresponding to two or more sides of die 5.

35 In the variant of figure 4, the dehumidification means 10 of device 1 include, downstream the

radiator exchanger 14 and in flow communication thereto, a drier 16 with rotating disks having hygroscopic material to absorb the residual damp of the dehumidified air 50.

5 The rotating disks, of known type, are crossed by a plurality of transversal openings whose inner surface has the hygroscopic material, for instance, consisting of lithium chlorate salts or, preferably, silica gel.

10 The rotation of the disk alternatively sets each transversal opening in communication with the flow of air to be dehumidified, which transfers the humidity to the hygroscopic material, and with a countercurrent flow of heated air produced by a hot air generator 18, which dehydrates said material predisposing it for a following cycle.

15 The device operation according to the method for controlling the condensate and/or frost formation in chocolate shell production of the present invention provides to blow the dehumidified air 50, in the mutual detachment condition D of mould 2 from die 5, nearly at ambient pressure, in direction of protrusions 6 by the supply means 8, positioned at each side of die 5, and whose outlets 9 flow directly in the environment, preventing the condensate or frost formation on the face of die 5 having the protrusions 6.

20 The air, which is immediately downstream the radiator exchanger 14, is cooled at a temperature between around 0° C and around 30° C and it has a humidity percentage ranging between 10% and 60%. The dehumidified air 50 by the absorption through the disk drier 16, as provided in the variant of figure 4, has a humidity ranging between around 0% and around 10% and it is heated, before the blowing, at a temperature included between around 5° C and around 35° C,  
25 preferably of around 22° C.

Such heating of the dehumidified air 50 is carried out by thermal energy transferred from the hot air generator 18 to the disks through the dehydration air of the hygroscopic material.

30 ~~The method~~ further provides to use in the exchanger 14 a fluid cooled by the cooling means 7 of die 5; to filter, through the filter means 17, the dehumidified air 50 prior the blowing and to stop or to reduce the blowing at the maximum approach condition A, by acting on the blowing means 15.

35 The humidity percentage and the temperature of the dehumidified air 50 are regulated by

respective controls of the refrigerating machine 13, in accordance with the typology of chocolate 4 and/or the duration of maximum approach condition A with respect to the duration of a entire moulding cycle of the chocolate shell.

- 5 The invention also provides that at least a part of the air blown into the mould can be sucked by extractor fan means, known and not shown, and can flow thanks to said extractor fan means in the hot air generator 18 and/or fed in the radiator exchanger (14) together with the ambient air.

10 It must be observed that the air dehumidification allows to avoid condensate or frost formation on the protrusions in a very wide range of temperatures of said dehumidified air and that temperatures of many degrees above zero of such air do not endanger the protrusion cooling and the chocolate moulding because the low thermal capacity of air and the blowing at ambient pressure and low speed do not cause a significant temperature increase of protrusions.

- 15 The main advantage of the present invention is to provide a device for controlling the condensate or frost formation in chocolate shell production, whose portion which is associated to the die and the mould has small dimensions, flows directly in the environment and, therefore, does not require rooms or containers.

20 Other advantage of the present invention is to provide a method for avoiding the humidity condensation on the die by blowing dehumidified air at the surface thereof, at ambient pressure and directly flowing out in the environment, with adjustable temperatures in a wide range of values even higher than the temperature values of die protrusion or negative Celsius degrees.

- 25 Further advantage is to provide a device and a method, which can be easily assembled in preexistent and unarranged machines.